



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170001

Semester –VII

Subject Name: Summer Internship

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE (E)	PA (M)	ESE (V)	PA (I)		
0	0	4	2	0	0	80	20	100

The duration of internship will be two weeks. It will be after completion of 6th Semester and before the commencement of Semester VII.

Following five options can be opted by the students:

1. Offline internship in industry - Internship in industry subjected to permissions from Government and concern Industry subject to the conditions of following the SOP issued by Government and written consent of the student and parents. Student is supposed to produce joining letter and relieving letter once the internship is over in case of Offline internship in any industry.
2. Online internship in industry / other agencies
3. Seminar by student under mentorship of a faculty. The topic shall be as per UG Syllabus topics
4. Preparation of consolidated report on survey of materials used in the respective branch of the student. The work should include the study of catalogues, price list specifications, properties, usage notes and other technical details and drawings etc, Work shall be carried out under the guidance of faculty. A detailed report shall be submitted. It shall be done by only one student. It is to be completed individually.
5. A Mini Project- on some suitable topic related to respective branch. It can be small fabrication / experimental results/ simulations / Programmes/ application development etc depending on the branch of the student. Preferably a single student should do it.

Other guidelines:

- Student has to prepare detailed report and submit to his/her college. A copy of report can be kept in the departments for record.
- Each student must be assigned a faculty as a mentor from the college and an Industry expert as co-mentor.
- The evaluation of the work done by students will be carried out after 2 weeks by the internal and external examiner.
- External examiner will evaluate for 80 marks and internal examiner will evaluate for 20 marks.
- The presentation by student in the presence of all student is desirable.

Student should produce successful completion certificate in case of offline / online internship in industry.



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170609

Subject Name: Irrigation Engineering
Semester – VII

Type of course: Professional Elective Course

Rationale:

India is an agricultural dominated country. Agricultural production has a substantial contribution in the gross domestic product (GDP). Agricultural production entirely depends upon availability of water for the crops. Mainly water is available naturally in the form of rains or artificially by irrigation to the fields. Non-uniform distribution and inadequate rains in our country give rise to apply water artificially in the form of irrigation. The deliverance of water through surface irrigation system requires understanding of storage works, design of conveyance systems, knowledge of canal regulation devices and canal outlet works. The knowledge of various cross-drainage works falling across the alignment of canal is also required to an irrigation engineer. Information and knowledge about Soil-water relationships, water requirements by various crop is essential for efficient use of irrigation water.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	<p>Module 1: Irrigation Introduction- Definition, Necessity, Scope, Benefits and ill effects of irrigation, Types of irrigation schemes, Social and environmental considerations, Irrigation development and water resources potentials in India.</p> <p>Water Requirement of Crops- Methods of irrigation, Various modes of application of irrigation water Crop seasons in India, Principal Indian crops Soil-water-plant relation- field capacity, wilting point, available water, Consumptive use and its empirical methods, Irrigation requirements – Net irrigation requirement, Field irrigation requirement, Gross Irrigation requirement, Soil moisture extraction pattern, Frequency of irrigation, Gross command area, Culturable command area, Intensity of irrigation, Duty and delta relation, Irrigation efficiency, assessment of irrigation water</p>	10
2	<p>Module 2: Diversion Works: Diversion head works, Weir and barrages, Various parts of diversion head works and their functions, Types of weir, Causes of failures of weir on permeable foundations, Principles of weir design on permeable formations -Bligh's creep theory, Lanes weighted creep theory and Khosla's theory, critical gradient, Exit gradient, Khosla's method of independent variables, location of hydraulic jump, basic factors for design of weir floor</p>	15



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170609

	Storage works: Embankment dam: Classification of dams, site assessment and selection of type of dam, Environmental impacts of dam, Types of earthen dams, Methods of construction, causes of failures, Seepage in earth dams: Location of phreatic line in earthen dam, Rock-fill dams Gravity dams, Forces acting on a gravity dam, Modes of failure, load combinations for design of gravity dam, and stability analysis and design of gravity dam	
3	Module 3: Distribution works: Modes of conveying irrigation water- Types of irrigation canals- contour canal, ridge canal, side sloping canals, canal alignment Method of design of unlined section of irrigation canal, Kennedy's and Lacey's Silt theories, Silting and scouring of canals Canal sections-filling, cutting, partial cutting and partial filling, Balanced depth, Canal FSL, Capacity factor and Time factor, Longitudinal section, Schedule of area statistics and channel dimension, canal losses Lined canals, Design of lined canal, Link canals	8
4	Module: 4 Regulating and Cross Drainage Works: Canal falls, development of various types of falls, Classification of falls and its selection, Cross drainage works, Types of cross drainage works and its selection, Design consideration of cross drainage work, Design discharge of drainage and waterway, uplift pressure Canal escapes, Head regulator and Cross regulator, Meter flume, Irrigation outlets and types of outlets.	8
5	Module: 5 Water logging: causes and prevention, ill effects of waterlogging, Land Reclamation, management of irrigation water, Characteristics of irrigation water, Types of Drainage system	4

Distribution of Theory Marks (Percentage)					
R Level	U Level	A Level	N Level	E Level	C Level
20	20	20	20	10	10

Suggested Specification table with Marks (For BE only):

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Irrigation & Water Power Engineering - Dr. B.C.Punmia & B.B.Pande, Laxmi Publications, (P) Ltd, New Delhi
2. Irrigation, Water Resources & Water Power Engineering - Dr. P.N.Modi, Standard Book House, Delhi
3. Irrigation, Water Power & Water Resources Engineering - Dr. K.R.Arora Standard Publishers Distributors, Delhi



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170609

4. Irrigation Engineering and Hydraulic Structures - S.K.Garg, Khanna Publishers, Delhi
5. Irrigation Engineering, S.K. Mazumder, Galgotia Publications Pvt Ltd., New Delhi
6. Irrigation Engineering, G.L.Asawa, New Age publications, New delhi
7. Hydraulic Structures, P. Novak, A.I.B. Moffat, C. Nalluri and R. Narayanan, Taylor and Francis Group

Course Outcomes: At the end of the course, Student will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Assess consumptive Irrigation requirement based on values of Duty and Delta of different crops and plan an irrigation system	20
CO-2	Design lined and unlined canals	15
CO-3	Plan diversion head works and design it based on piping and uplift theories	15
CO-4	Plan various irrigation canal structures in the canal network as per the site situation and requirement	20
CO-5	Analyze gravity and earth dams and identify type of spillway and energy dissipation work	20
CO-6	Select suitable drainage system to reclaim water logged soil.	10

the bold words in the course outcome refer to the verbs of blooms taxonomy

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

List of Tutorials

1. A detailed note on Irrigation development and water resources potentials in India.
2. Design a storage capacity of reservoirs based on the crop sown in the area
3. Compute field irrigation requirement of crop using soil water plant relationship
4. Design weir floor using Khosla's theory
5. Carry out stability analysis of gravity dam
6. Design unlined canal using silt theories
7. Design a lined canal section.
8. Compute balanced depth of cutting and filling for a deigned channel section
9. Compute design discharge and water way in case of cross-drainage work
10. Describe a suitable cross drainage system to reclaim water logged soil

List of Open Source Software/learning website: nptel.ac.in



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170614

SUBJECT NAME: Construction Engineering and Management
SEMESTER-VII

Type of course: Management

Prerequisite: Building construction

Rationale: Knowledge of construction project plans, allocate resources and analyze workload, track work progress, estimation of project costs and manage budgets etc. are very important aspects of construction project management. In addition to these, various skill sets such as management of complex construction works, safety and quality in construction projects etc. needs to be required for successful execution of any project. This subject covers all above aspects required to know by the students of civil engineering.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	0	70	30	00	00	100

Content:

Sr. No.	Content	Total Hrs
1	Introduction: Features of Construction Projects, phases of construction project, Stakeholders of construction management.	2
2	Construction project planning- Stages of project planning: Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content, concept of productivities, estimating durations, sequence of activities, activity utility data; Techniques of planning- Bar charts, Line of balance, Mile stone charts. Planning and organizing construction site and resources- Site: Site layout including enabling structures, developing site organization; Manpower: Planning, organizing, staffing, motivation; Materials: Concepts of planning, procurement and inventory control; Equipment: Basic concepts of planning and organizing; Funds: Cash flow, sources of funds; Histograms and S-curves, resource scheduling, allocation, smoothing and leveling, common good practices in construction Networks: Basic terminology, types of precedence relationships, preparation of CPM networks: activity on arrow and activity on node representation, computation of float	18



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170614

	values, critical paths, and calendaring networks. PERT analysis, calculation of probability of completion.	
3	Project Monitoring & Control - Network crashing and cost time trade off, Periodic progress reports, and periodical progress meetings, purpose, frequency and methods of updating plans. Modern project management Systems: Lean construction; use of Building Information Modeling (BIM) in project management.	8
4	Quality control: Concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of inspection, basics of statistical quality control, CONQUAS- Construction Quality Assessment System Safety, health and environment on project sites: Accidents; their causes, effects and preventive measures, costs of accidents, Health and Safety Policies/Standards: OSHA, ISO 45001, occupational health & safety hazards in construction.	5
5	Construction equipment: Conventional construction methods Vs Mechanized methods Equipment: Capacity, Feasibility, owning and operating cost and Productivity of Different Equipment: Earthmoving, dewatering, concrete mixing, lifting, transporting & placing, pile boring/driving equipment, tunnel boring machines.	12

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
5	10	25	30	30	--

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

- 1) Construction Planning, Methods and Equipment, R.L Peurifoy, McGraw Hill, 2011
- 2) Construction Project management, Theory & Practice, Kumar Neeraj Jha, Pearson Education India.
- 3) Project Planning with PERT and CPM, B. C. Punmia, K. K. Khandelwal, Laxmi Publications.
- 4) Construction Planning and Management, P. S. Gehlot and B. M. Dhir, Wiley Eastern Ltd.
- 5) A management guide to PERT/ CPM by Weist and Levy, Prentice Hall
- 6) Construction of Structures and Management of Works, S. C. Rangwala, Charotar Publications.
- 7) Construction Engineering & Management By S. Seetharaman, Umesh Publication
- 8) Lean Construction Management by Shang Gao · Sui Pheng Low, Springer
- 9) Construction Project Management by K. K. Chitkara, Tata McGraw-Hill Education
- 10) BIM and Construction Management: Proven Tools, Methods, and Workflows By Brad Hardin, Dave McCool, John Wiley & Sons



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170614

- 11) CONQUAS: The CIDB Construction Quality Assessment System by Singapore. Construction Industry Development Board
- 12) Occupational Safety, Health & Environment And Sustainable Economic Development by Pradeep Chaturvedi (ed.), Concept Publishing Company Delhi
- 13) Construction Health and Safety Management by Alan Griffith, Tim Howarth, Routledge.
- 14) Construction Equipment and its Planning and Application, Mahesh Varma, Metropolitan Book Co.

Course Outcome:

After learning the course the students should be able to:

Sr. No.	CO statement	Marks % weightage
CO-1	Outline components and phases of construction project.	10
CO-2	Infer types of project plans, Work break down structure, Planning techniques, CPM and PERT techniques project scheduling & management.	40
CO-3	Illustrate periodic progress reports, Updating of plans, Cost Optimization,	25
CO-4	Derive evaluation criteria and attributes for Construction Projects	25

List of Experiments / Tutorials:

1. Develop a WBD structure for the construction of one storied building; Develop a bar chart for the construction of this building, including finishing activities, assuming reasonable activity durations.
2. Develop a CPM chart for a 5 span bridge on open foundations. Develop a comparative table for a 10-storied building constructed by at least three different methods, listing their pros and cons.
3. Develop a Gantt chart for the construction of a two storied precast framed structure, including open foundations, along with list of equipment resources, assuming reasonable quantities and productivities. Calculate cost optimization and updating of the same structure.
4. Develop a bar chart for concreting 1500 sqm of a 15cm thick slab using various equipment for production to placing of concrete at 3 m height above ground level; show all equipment resources required, along with a site layout.
5. For the construction of a typical 3 storied, framed structure with 400 sqm area per floor develop the histograms for the various resources required, showing all intermediate calculations; also, draw S-curves for concrete placing and block work done over the period.
6. Write a 500-word note on the advantages of Lean construction method over conventional project management systems.
7. Write a 500-word note on the Safety and health precautions you would take for a typical 3 storied building with 400 sq. m. plinth area.
8. A site visit of heavy construction project should be arranged to show the working of construction equipment's like dragline, bull dozers, clamshell, belt conveyors, scrappers, compactors, etc.

Major Equipment: Computer with all supported software.

List of Open Source Software/learning website:



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170614

Open source softwares:

1. Geniebelt
2. Buildtools
3. Knowify
4. CIMS - Construction Information Management System

Other softwares

1. MS Project
2. Primavera
3. Revit for BIM modeling
4. Visilean

learning website

<https://nptel.ac.in/courses/105104161/>

<https://www.youtube.com/watch?v=JcwqysQ1jRU>

GTUQuestionPapers.com



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170615

Subject Name: Engineering Economics, Estimation and Costing Semester – VII

Type of course: Professional Core Course

Rationale: This course is designed to develop the ability in the students the basic knowledge of engineering economics, materials of construction, construction technology, building planning and drawings. In the construction of any structure, specifications of civil work are the significant parameters in deciding the cost of the project. In construction, it is often required to use the local materials for which the rates are varying in greater extent across the country. Therefore, there emerges need of discipline to suggest a specific scientific technique to determine the quantity and cost of the materials along with its justification. Today being the era of technology, a provision been also made to use the various software's for more accuracy and speedy determination of estimation and costing.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	Introduction to Engineering Economics: Introduction to Engineering Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics – Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis – V ratio, Value engineering, Cash flow, Replacement and maintenance analysis, Economic decision making, Evaluating alternatives by- effect of taxation on comparison of alternatives, effect of inflation on cash flow, Evaluation of public projects, Benefit cost ration method.	06
2	Estimation: Definition, Units of measurements, types of estimates, Different methods to find the quantities of civil works. Estimated cost and its importance. Provisions of IS-1200, for working out quantities and deductions in civil works. Entering the measurements in quantity sheet and calculation of quantities of various items of civil works for residential, commercial and industrial buildings, Highway, Dam, Culvert etc. Market rates of material and labour, Introduction to schedule of rates, Abstracting and Billing: Purpose of abstract, preparation of abstract, measurement and billing, Checking of bills and final bill. Book Keeping:	10



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170615

	Work abstract, material at site account, measurement book, muster role hiring and maintenance of equipment, record of bills, vouchers and receipt book.	
3	Specifications: Definition, Objectives and importance of specification, Types of specification, Care to be taken while drafting specifications, Drafting general specifications, and detailed specifications for various civil work items- Specification of materials, specification of works, specification as per building classification, Language of specific writing. Market Survey: Traditional and modular materials, Market survey of materials of Construction, Wages of labour, Tools plant and equipment of construction.	06
4	Rate Analysis: Definition of rate analysis, Factors affecting rate analysis, overhead expenses, procedure for rate analysis, schedule of rates, Definition of task, Determination of man power and material requirement for a given quantity of items of civil works, study of present wages of labour and prices of traditional and modular materials in the market. Study of market rents of different construction tools plant and equipments, Determination of rate of different items of civil work. Working out rates of various items of civil works.	06
5	Contract: Definition, legal requirements of a valid contract, types of contracts, conditions of contract, sub contracts and contractual disputes, Arbitration. Form of Contract, Responsibility of owner, Architect, Contractor and Engineer.	03
6	Tender and Tender notice: Bidding process, e-tendering, Prequalification process, tender notice and its essential features, drafting tender notice, Bid submission, Analysis of tenders, Basis for evaluation and acceptance, letter of intent, work order, agreement.	03
7	Valuation: Definitions of value, price and cost, depreciation, sinking fund, different type of values and their significance, factor affecting value, rent and standard rent, Lease hold and free hold property, obsolescence, Gross income, Outgoing and Net income, Capitalized value and Years purchase, valuation tables, Easement, types of easements, significance of easement in valuation, Methods of valuation of buildings and land, Estimation of values of different types of buildings and lands.	08

Course Outcomes: At the end of the course, Student will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Apply the basics of economics and cost analysis to engineering and take economically sound decision making.	20
CO-2	Prepare rate analysis, specifications, tenders and contract of different civil work.	20
CO-3	Prepare approximate and detailed estimate of a civil engineering work.	20
CO-4	Utilise software for working out quantities of items of civil works.	20
CO-5	Solve examples on valuation of properties/ buildings.	20



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170615

Suggested Specification table with Marks:

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
30%	20%	20%	15%	15%	-

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

- 1 Chan S.Park, Contemporary Engineering Economics, Prentice Hall of India, 2002.
- 2 Panneer Selvam, R, "Engineering Economics", Prentice Hall of India Ltd, New Delhi, 2001.
- 3 B. N. Dutta, Estimation and Costing In Civil Engineering, Ubs Publishers Distributors, Ltd.
- 4 S. C. Rangwala, Estimating and Costing, Charotar Publishing House.
- 5 G. S. Birdi, Textbook of Estimating & Costing, Dhanpat Rai and Sons, Delhi.
- 6 M. Chakraborti, Estimating, Costing, Specification and Valuation.
- 7 S. C. Rangwala, Valuation of Real Properties, Charotar Publication.
- 8 P.W.D. Handbook and SOR, IS Code – 1200.
- 9 Donald.G. Newman, Jerome.P.Lavelle, "Engineering Economics and analysis" Engg. Press, Texas, 2010.
- 10 Degarmo, E.P., Sullivan, W.G and Canada, J.R, "Engineering Economy", Macmillan, New York, 2011.
- 11 Zahid A khan: Engineering Economy, "Engineering Economy", Dorling Kindersley, 2012

List of Experiments:

- 1 Examples on engineering economics.
- 2 Work out quantities of various items of civil works from working drawings of residential, industrial and commercial buildings.
- 3 Work out quantities of various items of civil works from drawings of culverts, L/s and C/s of Highways, etc.
- 4 To work out rates of items of civil works
- 5 Examples on valuation of land and buildings.
- 6 Drafting specifications for various items of civil works.
- 7 Use of EXCEL, AutoCAD for calculation of Quantity.
- 8 Overview of software Revit, Tekla, BIM, , MS Project, Primavera etc

Major Equipment:

Computer system supporting the softwares like Revit, Primavera, BIM, Tekla , MS Project, etc.

List of Open-Source Software/learning website:

nptel.ac.in



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170616

SUBJECT NAME: Retrofitting of structures

SEMESTER-VII

Type of course: Professional Elective Course

Prerequisite: Concrete technology, Structural Analysis, Design of Reinforced Concrete structures

Rationale: Reinforced concrete structure has always been the first choice for the construction industry world over. This composite material has proved its robustness and versatility, however considering it to be an immortal material and not giving proper attention in the early days resulted into many catastrophic failure which could have been averted with prior precautionary measures. Concrete structures are subjected to constant deterioration due to effects of ageing, inadequate maintenance, severe environmental exposure, penetration of catalytic agencies such as moisture, gases like CO₂ & oxygen, chloride ions, industrial pollutants, abuse (over-used and misused) etc. This deterioration needs to be timely arrested before it leads to irreversible damage making it imperative to repair and upgrade (retrofit/strengthening) the current stock of deteriorated and deficient structures. This course has been designed with an aim to give the students an insight into the subject of concrete repair, its protection and strengthening.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	Introduction: Overview of distress, deterioration in concrete structures, Case studies of distressed structures world over, Need for repairs and upgrading of structures, General introduction to process (Road-map) to a durable concrete repair	03
2	Deterioration of concrete structures: Types of deterioration – Signs, causes & symptoms, Mechanism of deterioration – Physical, Mechanical, Chemical, Deterioration due to ageing, Design & construction deficiencies, overloading, water leakage, Fire, Inadequate maintenance, etc. Corrosion of reinforcement (chloride induced, carbonation induced). Visual deterioration of structures- Cracking – Types, causes & characteristics of cracking in various structural components like beam, column, slab, masonry walls. Measurement of cracks, interpretation of the cause of particular type of cracking, effects of cover thickness, Provisions in accordance to IS 456 for ensuring durability in structures	10



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170616

3	Conditional assessment / Evaluation of structures: Structural assessment: Conditional evaluation / Structural Appraisal of the structure, Damage assessment procedure, Preliminary & Detailed investigation & Rapid visual screening/ inspection of structures Damage Assessment allied Tests (Destructive, Semi-destructive, Non-destructive): Field & laboratory testing procedures for evaluating the structure for strength, corrosion activity, performance & integrity, durability index. Interpretation of the findings of the tests.	12
4	Repairs, rehabilitation & Retrofitting of concrete structures: Repair materials - Criteria for durable concrete repair, Methodology, performance requirements, repair options, selection of repair material, Preparatory stage of repairs, Different types of repair materials & their application, types of repair techniques. Retrofitting / Strengthening: - Need for retrofitting, Design philosophy of strengthening structures, Techniques available for strengthening including conventional and innovativetechniques. Seismic retrofit of concrete structures :Local & global deficiencies in structure requiring seismic retrofit, Design philosophy, Techniques to enhance the seismic resistance of structures.	12
5	Allied topics: Protection & maintenance of structures - Importance of protection & maintenance, Categories of maintenance, Building maintenance. Corrosion mitigation techniques to protect the structure from corrosion. Quality control in concrete – Aim & importance of quality control in concrete construction, measures to assure quality in construction through testing & inspection.	08

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	30	30	10	10	-

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Concrete microstructure, Properties and materials – P Kumar Mehta and Paulo J.M.Monterio
2. Handbook on Repairs and Rehabilitation of RCC buildings – CPWD, Government of India.



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170616

3. Repairs and Rehabilitation of Concrete Structures by Poonam I. Modi and Chirag N. Patel, PHI Publication.
4. Structural Renovation in Concrete - Zongzin Li, Christopher Leung, Yunping XI – Spon Press
5. Appraisal and Repair of Reinforced concrete by R.Holland, Thomas Telford Ltd. London.
6. Concrete Repair and Maintenance Illustrated – Peter H. Emmons, Galgotia Publications.
7. Concrete technology – A.R.Shanthakumar, Oxford University Press, India
8. Maintenance, Repair and Rehabilitation and minor works of buildings – P.C.Varghese, PHI Publication.
9. Structural Condition assessment by Robert T. Ratay.

Course Outcome:

Sr. No.	CO statement	Marks % weightage
CO-1	Identify and define all the terms and concepts associated with deterioration of concrete structures.	20
CO-2	Carry out the damage assessment and Rapid Visual inspection of a building showing signs of deterioration and thus should be able to detect the possible cause /source of deterioration	30
CO-3	Develop a knowhow of the Concrete repair industry equipped with variety of repair materials and techniques.	25
CO-4	Describe and apply the importance of quality control in concrete construction and significance of protection and maintenance of structures.	25

List of Experiments:

1. Take up Conditional Assessment of 5 different structures including Residential, Commercial, Industrial, Government buildings, Private structures (old & new construction both). Prepare Rapid visual inspection data sheets of the same.
2. Prepare a report on the buildings surveyed, to highlight all the defects/deterioration seen through proper resolution photographs. The report must clearly indicate the distress – its source and symptoms.
3. To perform the Non-destructive & Semi-destructive testing on the cast specimens of beams using set-up of Rebound hammer, USPV, Core drilling etc. and thereby prepare a report on the Interpretation of the strength i.e quality of concrete based on NDT test results.
4. To perform experiment to evaluate the Compatibility between the substrate material concrete and any repair material. (For instance comparing the Bond strength of Polymer modified mortar and Conventional Mortar with Concrete).
5. Experiment investigation to carry out the efficacy of repair material/ technique in enhancing the strength of concrete beam post cracking. (For instance, Cast a RCC beam, simulate cracking and then filling the crack with repair material and check the post-repair strength results).

Major Equipment: Compression Testing Machine, Concrete Mixture, NDT equipments like USPV, Rebound Hammer, Corrosion Meter, Rebar Locator, Engineer's inspection Kit.

List of Open Source Software/learning website:

1. <http://www.icri.org>

2. <http://www.nbmcw.com>



GUJARAT TECHNOLOGICAL UNIVERSITY
Bachelor of Engineering
Subject Code: 3170617
Semester – VII
Subject Name: Application of GIS in Civil Engineering

Type of course: Professional Elective Course-IV

Prerequisite: NIL

Rationale:

1. To impart knowledge of data sciences and geo-spatial techniques in analysis of Civil Engineering issues.
2. To build the Civil Engineering projects on Geo-Spatial tools for better decision making.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	GIS and civil engineering projects – Urban planning, Hydrology and floods, Soil management, Water supply, Water distribution, Storm water, Solid and hazardous waste management, Transportation and utility system.	8
2	Introduction to ArcGIS / QGIS Desktop GIS - Exploring for spatial and non-spatial data operations, analysis and management.	8
3	GIS and data science – Spatial data structure and topology, Raster and vector data models, Map projections, Coordinate systems, Map scales, Selecting and editing features, Non-spatial database models, Data query, Displaying and editing tables, Joining and linking tables, GIS spatial data sources on the Internet, Creating new data sets, Data accuracy, Data redundancy.	14
4	GIS modeling approaches in project management – TIN and DEM analysis, Analytical modeling in GIS, GIS interfaces, GIS post-processing, dynamic visualization, Decision making.	12



GUJARAT TECHNOLOGICAL UNIVERSITY
Bachelor of Engineering
Subject Code: 3170617

Suggested Specification table with Marks (For BE only):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10%	10%	40%	10%	10%	20%

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Ian Heywood et al., Geographical Information System, Pearson, 2019
2. Bhatta B., Remote Sensing and GIS, Oxford University Press, New Delhi, 2008
3. Lo C.P. and Yeung Albert K.W., Concepts and Techniques of Geographical Information Systems, Prentice-Hall of India Pvt. Ltd. New Delhi, 2006
4. Burrough P.A and McDonnell R.A., Principles of Geographic Information Systems, Oxford university press, 1998
5. Stan Aronoff, "Geographical Information Systems", WDL Publications, Ottawa, Canada, 1989.

Course Outcomes: The students will be able to;

Sr. No.	CO statement	weightage
CO-1	Apply knowledge of GIS to different fields of civil engineering.	20%
CO-2	Implement ArcGIS / QGIS in civil engineering projects.	25%
CO-3	Create new datasets for geospatial analysis.	30%
CO-4	Perform modeling on GIS platforms	25%

List of Tutorials/Activities:

1. Mini-project on soil geospatial data mapping and management
2. Mini-project on Land use/cover geospatial data mapping and management
3. Mini-project on site selection for major infrastructure with geospatial data
4. Mini-projects on natural disaster mitigation with geospatial data



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170617

List of Open Source Software/learning website:

1. QGIS (Free) <https://qgis.org/en/site/forusers/download.html>
2. SRTM 90m Digital Elevation Data (Free) <http://srtm.csi.cgiar.org/>
3. Commercial ERDAS Imagine <http://gi.leica-geosystems.com/LGISub1x33x0.aspx>
4. ER Mapper <http://www.ermapper.com/>
5. IDRISI <http://www.clarklabs.org/>
6. Freeware Multi Spectral (A Multispectral Image Data Analysis System)
<http://cobweb.ecn.purdue.edu/~biehl/MultiSpec/>

GTUQuestionPapers.com



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170618

SUBJECT NAME: DESIGN OF STEEL STRUCTURES

B.E. SEM-VII

Type of course: Professional Elective Core

Prerequisite: Structural Analysis, Design of structure

Rationale: Many civil engineering structures are made up of steel. Knowledge of designing and detailing of steel structures is very important for civil engineers in order to make structures safe and serviceable during its life span. Limit State design philosophy is currently used worldwide for design of steel structures and its various components. Also precise and correct detailing of structural drawing is necessary in order to get the correct behavior of structures and leads to smooth construction of structures. This course will provide detailed knowledge of design and detailing of steel structures as per Indian standards.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Note: IS:800 (2007), SP 6(1), IS-1893-1(2016), IS-875 (Part 3) are permitted in the examination.

Content:

Sr. No.	Content	Total Hrs
1	Unit-1: Introductions Loads & Load combinations: Appraisal of loading standards such as I.S, I.R.C., Effect of wind and earthquake on structure Connections: Stiffened and unstiffened, moment & shear resisting structural connections, design and detailing of various connection - roof truss to column, column to beam, beam to beam and truss to bed block.	10
2	Unit-2: Design of Plate Girder Modes of failure : Elastic buckling, Bending in the plane of web, Local buckling, Buckling in the plane of web, Vertical buckling of the compression flange, Shear buckling Design of bolted, welded plate girder by Tension field Method & Simple Post Critical Method including design of vertical & horizontal stiffeners, Splices, Curtailment. Detailing of various elements of Plate girder.	12
3	Unit-3: Design of foot-over bridge Structural system of through & deck type bridges, design of foot-over bridge & its Supporting system. Detailing of Various elements of Foot over bridge.	10



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170618

4	Unit-4: Plastic Design Introduction to plastic method of analysis, Design of continuous beams and portal frame using plastic design approach.	08
5	Unit-5: Design of Gantry Girder Gantry girder – static and moving loads selection & design of section. Detailing of Gantry girder.	05

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
05	10	30	30	20	5

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. N. Subramaniam, Design of Steel Structures, Oxford University Press
2. S. S. Bhavikatti, Design of Steel Structures: By Limit State Method as Per IS: 800-2007, I K International Publishing House Pvt. Ltd
3. P. Dayaratnam, "Design of Steel Structures", S. Chand Group
4. IS 800:2007, General Construction In Steel - Code of Practice, Bureau of Indian Standards, New Delhi.
5. SP 6 (1) – handbook for Structural Engineers – Structural Steel sections
6. IS: 875 (Part I to V) - Code of practice for structural safety of Buildings Loading standards
7. IS: 1893 - Criteria for earthquake resistant design of structures

Course Outcome:

Sr. No.	CO statement	Marks % weightage
CO-1	Determine various types of loads acts of the framed structures and design the connections of Steel framed structure & Industrial structures.	20
CO-2	Prepare structural lay-out, determined loads & designed forces for different structures of the syllabus	30
CO-3	Apply the design principles, procedures and current Indian codal provisions for design & detailing of different structures of syllabus.	30
CO-4	Apply the principles of plastic design in steel beams & portal frames	20



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170618

Term Work :

Term work shall consist of satisfactory completion and submission of following list of Practicals/Tutorials.

List of Practicals /Tutorials:

1. Full Design of at least 01 structure from the following with detailing in A2 size drawing sheet covering all required details in structural drawing.
 - (1) Rivetted/Welded Plate girder
 - (2) Foot over bridge
 - (3) Gantry Girder
2. Solve at least 05 design examples from the topics covered in the syllabus.
3. Software applications of Connection design of Steel Framed structures & Industrial structures.
4. Preparation of EXCLE Worksheets for the design of various structural components of Plate Girder/ Gantry Girder/ Foot Over bridge.
5. Prepare at least one drawing in any CAD software (like AutoCAD) for design of structures conducted in the syllabus.

Practical examinations shall consist of oral based on the term-work and above course.

Major Equipment/Software:

1. Any professional software of Structural analysis such as STAAD-pro, SAP, ETABS

List of Open Source Software/learning website:

www.nptel.iitm.ac.in/courses/



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170619

Subject Name: Railway and Airport Engineering
Semester – VII

Type of course: Professional Elective Course V

Rationale:

Railway is important mode of surface transportation. Railways are economic for the long-distance transportation of passengers and freight on the land. India has the second largest Railway network in the world. At present in the India, the share of goods transportation in railway is reduced than the roadways. There is a very good scope of developing high speed trains and special corridors for freight transportation in India. The course covers fundamental knowledge of component parts, their function, design of track and overall operation of Railways.

Airports are important infrastructure for economic growth of any country. It requires large scale planning, design and construction. It requires huge amount of investment. Precise engineering skill is required for the planning, design, construction and maintenance of Airport structures. The course covers the fundamental knowledge of various important elements of Airport Engineering. It includes the planning and design of Airports.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	RAILWAY ENGINEERING: Module 1: General: Development of railways in India, Permanent way and railway track components, different gauges in India, conning of wheels, Functions of various Components - Rails, Sleepers and Ballast, Rails - types of rails, rail sections, defects in rails, creep of rails, rail fixtures and fastenings, rail joints and welding of rails, sleepers – types, spacing and density, Ballast – types, advantages and disadvantages, Subgrade – Requirement, embankment.	8
2	Module 2: Geometric design of railway track: gradients, grade compensation, speed of trains on curves, super elevation, cant deficiency, negative super elevation, curves, widening on curves. Track layouts, Switches, Tongue Rails, Crossings, Layout of Turnout – Double Turnout, Diamond crossing, Scissors crossing.	5
3	Module 3: Railway station and Yard: Railway traction and track resistance, stresses in railway track – rails, sleepers, ballast. Points and crossings – turnouts, switches, crossings. Track junctions – types, splits,	8



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170619

	diamond, gauntlet, scissor crossovers. Railway stations - requirements, facilities, classifications, platforms, loops, sidings. Railway yards – types, required equipment in yards. Signaling and control system – objectives, classification, Interlocking of signals and points.	
4	AIRPORT ENGINEERING: Module 4: General: History, development, policy of air transport, aircrafts, aerodromes, air transport authorities, air transport activities, air crafts and its characteristics, airport classifications as per ICAO.	1
5	Module 5: Airport Planning: Regional planning-concepts and advantages, location and planning of airport as per ICAO and FAA. Airport Master plan, Airport site selection, Zoning laws, Airport Elements -airfield, terminal area, zoning laws, classification of obstructions, approach zone, turning zone, airport capacity, runway capacity, estimation of future air traffic, development of new airport, requirements of an ideal airport layout.	6
6	Module :6 Run Way Design: Wind rose and orientation of runway, wind coverage and crosswind component, factors affecting runway length, basic runway length and corrections to runway length, runway geometrics and runway patterns (configurations), Runway marking, threshold limits cross section of runway. Taxiway Design: Controlling factors, taxiway geometric elements, layout, exit taxiway, location and geometrics, holding apron, turnaround facility. Aprons -locations, size, gate positions, aircraft parking configurations and parking systems, hanger -site selection, planning and design considerations, Fuel storage area, blast pads. Wind direction indicator. LCN system of Pavement Design, Airfield Pavement – Failures, Maintenance and Rehabilitation.	8
7	Module 7: Terminal Area: Elements and requirements, terminal building functions, space requirements, location planning concepts, vehicular parking area and circulation network	2
8	Module 8: Grading and Drainage: Airport grading -importance, operations, airport drainage aims, functions, special characteristics, basic requirements, Deign of drainage - surface and subsurface drainage systems,	2
9	Module 9: Air Traffic Control and Visual Aids: Need of Air traffic control, Air traffic control network, Air traffic control aids -landing information system, airport markings and lighting.	2

Course Outcomes: At the end of the course, Student will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Know about railway track components, their materials, size, function and importance	20



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170619

CO-2	Carry out geometric design of railway track	20
CO-3	Recognize about various components in diverging, merging and crossings of railway tracks, stations, yards, signaling, interlocking and control systems.	20
CO-4	To understand the fundamentals of planning and design of Airport structures.	10
CO-5	To design of runway and taxiways for Airport	20
CO-6	To comprehend the use of Air Traffic Control and Visual Aids in the air traffic operation.	10

Suggested Specification table with Marks (For BE only):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20%	20%	20%	20%	10%	10%

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Satish Chandra and M.M. Agrawal, "Railway Engineering", Oxford University Press, New Delhi
2. S.C. Saxena and S. P. Arora, "A Text Book of Railway Engineering", Dhanpat Rai & Sons, New Delhi
3. S.C. Rangwala, K.S. Rangwala and P.S. Rangwala, "Principles of Railway Engineering", Charotar Publishing House, Anand.
4. Dr. S. K. Khanna, M.G.Arora and S.S. Jain, "Airport Planning & Design", Nem Chand & Bros., Roorkee
5. G.V. Rao, "Airport Engineering", Tata McGraw Hill Pub. Co., New Delhi
6. S.C. Rangwala, P. S. Rangwala, "Airport Engineering", Charotar Publishing House Pvt. Ltd, Anand
7. Robert Horonief, Francis X. McKelvey, William J. Sproule, Seth B. Young, "Planning & Design of Airports", Mc Graw Hill Publication.
8. Arora S. P. and Saxena (2001), "Railway Engineering", Dhanpat Rai Publishers, New Delhi, 2001
9. Seth Young, Alexander T. Wells, "Airport Planning & Management", Macgraw Hill Professionals
10. Norman J. Ashford, Saleh Mumayiz, Paul H. Wright, "Airport Engineering: Planning, Design and Development of 21st Century Airports", John Wiley & Sons
11. Richard de Neufville, Amedeo Odoni, " Airport System: Planning, Design and Management", Mc Graw Hill Education.



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170619

List of Assignments based on:

1. Component parts of Railway track, importance and their functions
2. Geometric design of railway track
3. Signal control system of Railway
4. Runway and Taxiway design of Airport
5. Terminal area, parking and drainage system at Airfield
6. Air Traffic Control and Visual Aids

Technical Visit:

- 1) The visit of any Railway station and yard should be carried out for understanding the components of track and overall operation of Railway.
- 2) The visit of Airport site should be carried out to understand the various structures, its construction and operations.



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170620

Subject Name: Computational Geotechnics

Semester – VII

Type of course: Program Elective

Prerequisite: Knowledge of Geotechnical Engineering, Engineering Mathematics, Mechanics of Solids

Rationale: Computational Geotechnics is specialized subject dealing with numerical modeling, constitutive modeling, continuum and discrete modeling of various geotechnical problems in lieu with soil and rock behavior. Solutions of linear and non-linear equations using numerical approach and FDM approach are quite useful for many complex geotechnical issues. The course on Computational Geotechnics provides the students necessary skills to model various geotechnical problems viz. standard laboratory & field tests, analysis of tunnels, modeling flow problems, soil-structure interaction, earth retaining structures, cut slopes, embankments and foundations using numerical approach.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE(E)	PA (M)	ESE (V)	PA(I)		
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	Solution of Linear & Non-linear Equations: Jacobi's method, Gauss Seidal method, Successive over relaxation method. Bisection, False Position, Newton-Raphson, Successive approximation method, Iterative methods	12
2	Finite Difference Method: Two point Boundary value problems – Disichlet conditions, Neumann conditions; ordinary and partial differential equations.	08
3	Discrete modeling: discrete versus continuum modeling, introduction to discrete element method (DEM), DEM solution procedure, contact model and detect algorithms	07
4	Classical plasticity and soil behavior: One-dimensional (1D) plasticity theory basics, 1D frictional models, initial boundary value problems, integration algorithm, General framework of classical plasticity, elastic models and plastic models: Tresca, Huber-von Mises, Mohr-Coulomb, Drucker-Prager, Lade-Duncan, Cam clay, soil behavior and its relation to constitutive models, FEM solutions	11
5	Numerical solutions: General procedure, examples : 1D consolidation, Tri-axial test, Embankments, Foundation, Flow Through Porous Media	04

Reference Books:

1. S. Chandrakant, Desai and John T. Christian, "Numerical Methods in Geotechnical



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3170620

- Engineering”, Mc. Graw Hill Book Company, 1977.
2. M.K. Jain, S.R.K. Iyengar and R.K. Jain, “Numerical Methods for Scientific and Engineering computations”, Third edition, New Age International (P) Ltd. Publishers, New Delhi.
 3. Bowels, J.E., “Analytical and Computer methods in Foundation” McGraw Hill Book Co., New York.
 4. C.O’Sullivan, ”Particulate Discrete Element Modeling”, A Geomechanics Perspective, Spon Press, 2011
 5. S. Helwany, Applied Soil Mechanics with ABAQUS Applications, John Wiley & Sons, 2007

Course Outcomes: Students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Distinguish between different types of linear and non-linear solutions and its particular relevance	15
CO-2	Distinguish between different types of constitutive models and identify appropriate model according to soil type and loading conditions	20
CO-3	Select the correct integration algorithm for a specific constitutive model	10
CO-4	Explain basic concepts and models for discrete modelling, numerical procedures and interpret results in the geotechnical engineering context	35
CO-5	Conduct computer simulations to solve geotechnical engineering problems using FDM, FEM and other numerical solutions.	20

List of Experiments/Tutorials:

Numerical methods, FDM and FEA for various linear and non-linear materials, constitutive models, discrete models, tunnels, earth retaining structures, shallow foundations, embankments. Maximum no of problems may be equal to 5-7. Apart from above tutorials/experiments a group of students has to undertake one open ended problem/modeling problem based on any one applications of geotechnical engineering using any one software. Few examples of the same are given below:

1. Modeling soil parameters based on stress analysis.
2. Modeling elastic and elasto-plastic constitutive models – linear and non-linear.
3. Modeling Non-linear materials – Mohr-Coulomb soil, Huber-Von Mises, etc
4. FEM for seepage and consolidation problems.
5. Use of software for soil-structure interaction problems.

List of Open Source Software/learning website:

1. <http://nptel.ac.in/>
2. <http://ocw.mit.edu/courses/civil-and-environmental-engineering/>



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170621

Subject Name: DESIGN OF HYDRAULIC STRUCTURES

Semester – VII

Type of course: Professional Elective Course-V

Rationale:

Design of Hydraulic structures forms an integral part of water resources engineering projects. It includes selection of site for a particular type of dam, design and constructional features of Gravity dam, Embankment dams, and Rock fill dams. A hydraulic engineering has to develop understanding of principles of design of earth dam, gravity dam, spillways and energy dissipation devices.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	Module 1: Types of Dams and Foundation Treatment: Classification of Dams, Investigations for Dam Sites, Selection of site for Dams, Selection of Type of Dam, Merits and demerits of all types of dam, Importance of Subsurface Exploration, Foundation Treatment Methods, Materials and Techniques.	04
2	Module 2: Gravity Dams: Definition, Forces acting on the Dam, Combinations of load on the Dam, Causes of failure of Dams, Design criteria for Gravity Dams, Principal and Shear stresses, Elementary and Practical Profile of a Gravity Dam, High and Low Dam, Stability Analysis of a Gravity Dam, Design of Gravity Dams, Control of Temperature in Dams, Construction of dam, and joints in Dams, Galleries in Dams.	12
3	Module 3: Earth and Rock-fill Dams: Introduction, Earth Dam Definitions, Classification of Non – Rigid Dams, Causes of failure of Earth dams, Design Principles of Earth Dams, Profile of an Earth Dam, Side slopes and Protection Measures for Earth Dams, Core and Casing for Earth Dams, Construction Materials for Earth Dams, Cut off and Seepage Control Measures in Earth Dams, Drainage system for Earth Dams, Typical Sections of Earth Dams, Selection of Dam section, Construction of Earth Dams, Determination of Phreatic line, Stability of Slopes, Stability of Foundation against Shear, Design considerations in Earthquake Regions, Design of Earth Dams, Rock fill Dams.	13



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170621

4	Module 4: Spillways, Sluices and Crest Gates Definition and Types of Spillway, Components of Spillway, Chute Spillway, Side Channel Spillway, Shaft Spillway, Siphon Spillway, Design of Ogee Spillway, Profile of Ogee Spillway, Cavitation Erosion of Spillway Surface, Design of Chute spillway, Aeration Galleries, Spillway crest Gates, Sluices in dam	10
5	Module 5: Energy Dissipators: Energy Dissipation below Overflow Spillways, Energy Dissipation by Hydraulic Jump, Location of hydraulic jump, Design criteria for Stilling Basins and their design, IS Standardized Basins, Various methods of Energy Dissipation and their design.	06

Course Outcomes: At the end of the course, Student will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Choose suitable type of Dam and its sites for construction.	10
CO-2	Calculate forces, stresses on gravity dam and check various factor of safety.	30
CO-3	Locate phreatic line and carryout seepage and stability analysis of Embankment dam under various hydraulic conditions.	30
CO-4	Explain and Design Ogee and Chute spillway	15
CO-5	Explain and Design energy dissipation devices.	15

Note: Term work shall be based on above mentioned syllabus.

Suggested Specification table with Marks (For BE only):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15%	20%	20%	20%	15%	10%

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Irrigation Engineering and Hydraulic Structures by S R Sahasrabudhe
2. Irrigation Engineering and Hydraulic Structures by Dr. V C Agarwal
3. Irrigation and Water Power Engineering by Dr. B.C.Punamia,



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170621

4. Irrigation Engineering and Hydraulic Structures by S K Garg
5. Irrigation and Water Resources Engineering by G L Asawa
6. Irrigation Water Resources and water power Engineering by Dr.P.M.Modi
7. Theory and Design of Hydraulic Structures Vol. 1 and 2 by R.S.Varshney, S.C. Gupta, R.L. Gupta
8. Irrigation Engineering and Hydraulic Structures by S K Sharma
9. Irrigation and Hydraulic Structures: Theory, Design and Practice by Iqbal Ali
10. Hydraulic Engineering of Dams by Willi H. Hager, Robert M. Boes, Michael Pfister, Anton J. Schleiss
11. Hydraulics of Spillways and Energy Dissipators by Rajnikant M. Khatsuria

List of Open Source Software/learning website:

nptel.ac.in

GTUQuestionPapers.com



GUJARAT TECHNOLOGICAL UNIVERSITY
Bachelor of Engineering
Subject Code: 3170622
SUBJECT NAME: Precast Construction
SEMESTER-VII

Type of course: Professional Elective Course

Prerequisite: Concrete Technology, Design of Structures, Structural Analysis

Rationale: Building with Precast concrete components is as much old as constructing with concrete. Precast concrete construction however now has increased by leaps bounds and has taken industrialized form owing to development of heavy lifting equipment mechanized steel moulds, automated manufacturing systems. Precast concrete construction these days most sought after construction practice by developers as it facilitates construction, factory production presents excellent conditions for their use. However construction techniques lack wider appreciation due to lack of design instruction at undergraduate level and limited exposure of engineer to design concepts, manufacturing erection stages. The inclusion of this subject aims to provide the engineers with understanding & applications of Precast concrete construction.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1.	INTRODUCTION: Detailed description of Precast Concrete Construction. Difference between Precast and Other forms of Concrete construction. Advantages of this form of construction. Need for Prefabrication: Principles of prefabrication, Comparison with cast-in-situ construction, types of prefabrication, automation in manufacturing of precast elements, Modular Coordination, Standardization, Transportation , Erection Materials in Precast Structures – Mix design, Steel reinforcement, Structural steel, welding, inserts and bolts,	8
2	Structural Concepts of Precast concrete Systems : Loads, Load path, Limit states, Precast Concrete building systems, Pre-cast frame analysis, Overview of the Structural Ties,	8
3.	Design of Precast Reinforced Concrete Components: Precast Concrete Floors : Precast concrete flooring options, flooring arrangements, Structural design (flexural capacity, shear capacity, Bearing capacity) Precast Concrete Beams – Types of precast beams, Construction methods, loading arrangements, beam behavior, Composite & Non composite reinforced concrete beams Precast concrete Columns – Geometry, Strength and General requirements.	23



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170622

	Overview of the design requirements Precast Concrete walls – Functions, Types of precast concrete walls (infill shear walls), Distribution of horizontal loadings. Precast Concrete Connections – Design, Manufacturing & construction considerations, Types of connections, expansion joints in precast construction, provisions for non-structural fastenings	
4.	Production Technology & application : Choice of production setup, manufacturing methods, stationary and mobile production, planning of production setup, storage of precast elements, dimensional tolerances, acceleration of concrete hardening. Hoisting Technology - Equipment for hoisting and erection, techniques for erection of different types of members like beams, slabs, wall panels and columns, vacuum lifting pads. Applications - Designing and detailing of precast unit for factory structures, purlins, principal rafters, roof trusses, lattice girders, gable frames, single span single storied simple frames, single storied buildings, slabs, beams and columns.	6

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	20	20	20	15	5

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Precast Concrete Structures by KIM S. ELLIOT, Second Edition, CRC Press, Taylor & Francis Group.
2. Structural design manual", Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 2009.
3. The Structural Precast Concrete Handbook 2nd Edition, ISBN : 981-04-3609-2, Building and Construction Authority, May 2001.
4. Mook L, (1964), Prefabricated Concrete for Industrial and Public Structures, Publishing House of the Hungarian Academy of Sciences, Budapest.

Course Outcome:

Sr. No.	CO statement	Marks % weightage
CO-1	Identify the Design Principles, Special Characteristics and Rules associated with Precast Concrete Design and Construction.	25%
CO-2	Compare and Contrast the Design philosophy & construction techniques of Precast and Other forms of Construction	20%



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170622

CO-3	Describe the Structural System and load path of precast structures	20%
CO-4	Analyse and Design the Precast Structural elements	25%
CO-5	Choose the Production method and equipment for erection of precast elements	10%

List of Experiments:

1. Determine water absorption of Paver blocks of 3 different shapes of 3 different make and size.
2. Cast in house Precast Solid, Hollow Concrete Blocks and test the cast specimens for Water absorption and Compressive Strength.
3. Prepare a detailed report of Field Visit to Precast Manufacturing unit covering various aspects such as Manufacturing process, Curing, Handling, Stacking, In-house inspection and testing etc.
4. Cast of Wall panels and test the panel in flexure.

Major Equipment:

1. Hot Air Oven
2. Digital Weighing balancing of 10kg capacity
3. Compressive Testing Machine
4. Loading frame
5. Flexural Assembly

List of Open Source Software/learning website:

1. <https://precast.org/education/classes/webinars/precast-101/>
2. <https://www.youtube.com/watch?v=Llrr2tdfLEA>
3. <https://www.youtube.com/watch?v=uiQzx1YFOBs>



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170623

Semester – VII

Subject Name: Port and Harbor Engineering

Type of course:

Prerequisite: Nil

Rationale:

Safe, timely and economic transportation of passengers and goods is necessary for social and economical development of any region or nation. Roads and railways are important for the surface transport, whereas for the large quantity of cargo movement over the long distances at the national, international and intercontinental levels; waterway transportation is the most economical mode. Planning of new port requires proper knowledge of location, natural phenomena, environmental impacts, hinterland products, connectivity, forecast of passenger and cargo demand, infrastructure and management aspects. Planning, design, construction and maintenance of seaport components like harbor, docks, breakwaters, wharf, quay, jetty, transit sheds, warehouses, loading and un-loading devices, dredging, other navigation aids are essential for the civil engineering. Therefore, this subject is aimed to provide the clear understanding of the Port and Harbor components.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	1	0	4	70	30	0	0	100

Content:

Sr. No.	Content	Total Hrs
1	Introduction to Water Transportation: History, Scope, Merits, Developments of Water Transportation in India, Inland waterways, River, Canal, Inland water transportation, Harbor, Port, Dock, Development of Ports & Harbors, classification, Harbor site selection, Harbor dimensioning.	5
2	Port Planning: Characteristics of good seaport and principles of seaport planning, size of seaport, site selection criteria and layout of seaport, Dry ports, Bulk cargo, Transshipment ports, Port of call, Surveys to be carried out for seaport planning, regional and intercontinental transportation development, forecasting cargo & passenger demand, regional connectivity, cargo handling capacity of port.	6
3	Natural Phenomena: Wind, Tides, Water waves, Wind rose and wave rose diagrams, wave diffraction, breaking, reflection, Littoral drift, sediment transport, Effects on Harbor and structure design.	6
4	Harbor Infrastructures:	9



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170623

	Ship characteristics. Design of Harbor entrance, channel, turning basin, IS provisions, Breakwaters - function, types, general design principles, wharves, quays, jetties, piers, pier heads, dolphin, fenders, mooring accessories, IS provisions. Repair facilities, wet docks, lift docks, dry docks, gates for graving docks, floating docks, slipways, locks and gates.	
5	Port Amenities & Operations: Ferry, Transfer bridges, floating landing stages, transit sheds, warehouses, cold storage, aprons, cargo handling equipment, purpose and general description: stack area, single point mooring, IS provisions	6
6	Navigational Aids: Channel and entrance demarcation, buoys, beacons, light house electronic communication devices.	4
7	Seaport Maintenance: Costal protection-purpose and devices, sea wall protection-sea wall revetment, bulkhead. Dredging, dredgers-types and suitability, usage of dredged materials.	5
8	Impact analysis: Economic evaluation of port project, Environmental impacts of port activities.	4
	Total	45

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	15	20	20	15	15

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. R. Srinivasan and S. C. Rangwala, Harbour, Dock and Tunnel Engineering, 1995, Charotar Pub.House, Anand
2. S. P. Bindra, A Course in Docks and Harbour Engineering, 1992, DhanpatRai& Sons, NewDelhi
3. IS Codes: 4651 (Part I to V), 7314, 9527 (Part I, III, IV, VI), 10020 (Part IV).
4. Alonzo Def. Quinn, Design and Construction of Ports and Marine Structure, McGraw - Hill Book Company, New York



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170623

Course Outcomes: After studying this subject, students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	understand important planning concepts of harbor and ports	30%
CO-2	know important functional components of harbor and ports	30%
CO-3	understand important design concepts of harbor and ports components	40%

Assignments based on:

1. Forecasting of Cargo, Passengers for the Seaport
2. Windrose diagram and wave rose diagram
2. Lay out planning of Seaport
3. Components design of Seaport Infrastructure using IS codes
4. Dredging computation for the seaport area
5. Economic evaluation of the Port
6. Environmental impact analysis of the Port area

Major Equipment: Nil

List of Open Source Software/learning website: www.nptel.iitm.ac.in/courses/



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170624

**SUBJECT NAME: Design of Prestressed Concrete structures
SEMESTER-VII**

Type of course: Professional Elective Course

Prerequisite: Mechanics of Solids, Concrete Technology, Structural Analysis- I, Design of Structures

Rationale: This course is an elementary course on Design of Prestressed Concrete Structures. The course is specifically aim to familiarize with the basic concepts of prestressing and to develop understanding of various design philosophies, Indian Standard Codal provisions for the design of statically determinate Prestressed Concrete elements.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	<u>Module 1: Introduction</u> Basic Concepts of Prestressing, Historical Development of prestressing, Materials and systems for prestressing, Types of Prestressing, Advantages and Limitations of Prestressing.	03
2	<u>Module 2: Losses in Prestress</u> Introduction, Losses due to Friction, Losses due to Anchorage Slip, Losses due to Elastic Shortening, Time-Dependent losses due Creep, Shrinkage and Relaxation, Total immediate losses, Total Time-Dependent losses, Illustrative Examples.	05
3	<u>Module 3: Flexural Design of Prestressed Concrete Elements</u> Introduction, Types of Flexural Failures, Selection of concrete section and tendon profile, Strain Compatibility Method, Design of Pre-tensioned Beams, Design of Post-tensioned Beams, Design of Composite Prestressed Concrete Beams, Design of Simply supported Slabs, Camber, Deflection and Crack Control, End Block Design.	16
4	<u>Module 4: Shear and Torsional Strength Design</u> Introduction, Shear and Principal Stresses, Ultimate Shear Resistance of Prestressed Concrete Members, Design of Shear Reinforcements, Horizontal Shear	12



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170624

	strength in Composite Construction, Brackets and Corbels, Torsional behaviour and strength, Design for Combined Shear and Torsion.	
5	<u>Module 5: Prestressed Compression and Tension Members</u> Introduction, Types of prestressed Compression and Tension Members, their behaviour, Analysis and design of prestressed Compression and Tension Members	09

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
05	10	30	30	20	5

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. T. Y. Lin and Ned H. Burns, Design of Prestressed Concrete Structures, 3rd Edition, John Wiley and Sons
2. Edward G. Nawy, Prestressed Concrete – A Fundamental Approach, 5th Edition, Pearson Education, Inc.
3. Arthur H. Nilson, Design of Prestressed Concrete, 2nd Edition, John Wiley and Sons
4. Antoine E. Naaman - Prestressed Concrete Analysis and Design – Fundamentals, 2nd Edition, Techno Press 3000
5. N. Krishna Raju, Prestressed Concrete, 6th Edition, McGraw Hill Education (India) Private Limited
6. N. Rajagopalan, Prestressed Concrete, 2nd Edition, Narosa publications
7. IS: 1343 – 2012, Prestressed Concrete – Code of practice

Course Outcome:

Sr. No.	CO statement	Marks % weightage
CO-1	Apply the basic concepts of prestressing in various Civil Engineering Structures.	10%
CO-2	Assess the various prestressing losses in prestressed concrete elements as per Indian Standard Codal provisions	15%
CO-3	Analyse and design statically determinate prestressed concrete flexural elements and draught prestressing details.	35%
CO-4	Analyse and design the prestressed concrete elements for Shear and Torsion and draught detailing.	20%
CO-5	Analyse and design Prestressed Compression and Tension Members and draught prestressing details	20%



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170624

List of Experiments:

1. The students will have to solve at least five examples and related theory from each topic as an assignment/tutorial.
2. Prepare sketches of structural detailing of Prestressed Concrete Elements in sketch book/A3 size sheet.
3. Experiments may be designed and carried out related to the topics of the course such as Design, casting, prestressing and testing of Prestressed Concrete Elements.
4. Site Visit may be arranged related to the topics of the course such as Post-Tensioned / Pre-Tensioned Prestressed Concrete Beams, PT Slabs, Prestressed Sleepers, Electric Poles, etc.
5. Practical examinations shall consist of oral based on term-work and above course

Major Equipment:

1. Any professional software of Structural analysis such as STAAD-pro, SAP, ETABS, Midas Gen, ADAPT PT, SOFISTIK.
2. Universal testing machine/Compression Testing Machine/ loading frame & loading jack, Prestressing Bed, Concrete Mixture

List of Open Source Software/learning website:

<https://nptel.ac.in/courses/105/106/105106117/>

<https://nptel.ac.in/courses/105/106/105106118/>

<https://www.pci.org/>

<https://www.post-tensioning.org/>



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170625

Semester –VII

Subject Name: ENVIRONMENTAL IMPACT ASSESSMENT

Type of course: NA

Prerequisite:

Rationale:

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Sr. No.	Contents	Total hrs
1	Concepts of Environmental Impact Assessment : Environment; Environmental Impacts; Environmental Impact Analysis; Environmental Impact Assessment And Environmental Impact Statement; EIA- As An Integral Part of The Planning Process	6
2	Detailed Contents of EIA: Introduction; Project Description; Description of The Environment; Anticipated Environmental Impacts And Mitigation Measures: Analysis of Alternatives; Environmental Monitoring Programme; Additional studies; Project Benefits; Environmental Cost Benefit Analysis	10
3	Environment attributes: air; water; noise; land and soil. Description of the Baseline Environment : Purposes for defining the Environmental Setting; Selection of parameters, Monitoring of physical environmental parameters, Collection and interpretation of baseline data for various environmental attributes	8
4	Prediction and Methods of Assessment of Impacts on Various aspects of Environment; Application of various models for the Prediction of impact on Air Environment, Water Environment, Noise Environment and Land	8
5	EIA notification September 2006 and amendments: Categorization of projects, Procedure for getting environmental clearance. Public participation in environmental decision making process. Case studies on EIA for Industries and Infrastructure projects	10

Suggested Specification table with Marks (Theory):

Distribution of marks as per Blooms taxonomy					
R level	U level	A level	N level	E level	C level
10	25	25	20	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170625

Reference Books:

1. Environmental Impact Analysis Handbook – by Rau Whooten; McGraw Hill publications
2. Environmental Impact Assessment – by Larry Canter; McGraw Hill publications
3. Environmental Impact Analysis – A Decision Making Tool by R K Jain
4. Handbook of Environment Impact Assessment by Judith Petts; McGraw Hill publications

Course Outcome: After learning the course the students should be able to:

Sr. No.	CO Statement	% age weightage
CO1	Explain the importance of EIA as an integral part of planning process	20
CO2	Examine different environmental attributes and selecting the environmental parameters affecting project	30
CO3	Apply various methods to Predict the Environmental impacts of project after deciding various environmental attributes	30
CO4	Create the EIA report for getting Environmental clearance	20

List of Tutorials:

1. Questions based on Detailed Contents of EIA
2. Questions based on Environmental Attributes.
3. Questions based on Description of Environmental Setting.
4. Questions based on Prediction and Methods of Assessment of impacts
5. Questions based on EIA Notifications.
6. Case studies on EIA for Industries and Infrastructure projects



GUJARAT TECHNOLOGICAL UNIVERSITY
Bachelor of Engineering
Subject Code: 3170626
SUBJECT NAME: DESIGN OF INDUSTRIAL STRUCTURES
B.E. SEM-VII

Type of course: Professional Elective Core

Prerequisite: Structural Analysis, Design of structure

Rationale: The recent worldwide boom and investment in the Industrial construction, there is a high need of building technical competence in the design of Industrial structures. This subject provides knowledge of designing & detailing of few reinforced concrete and steel structures in industrial projects.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Note: IS:456(2000), IS:800 (2007), SP 6(1), IS-1893-1(2016), IS-875 (Part 3) & other relevant codes are permitted in the examination.

Content:

Sr. No.	Content	Total Hrs
1	Industrial Building: Structural layout of industrial building, Design of roof: (a) with trusses and (b) with Gable frame. Effect of wind loads on purlin and trusses, bracing systems, columns, Design of Gantry Girder with static and Moving loads.	12
2	Transmission and Communication towers: Types and configuration, Loads & load combinations be considered, Analysis and design of tower & foundations	06
3	Chimneys : Loads and stresses in chimney shaft, Earthquake and wind effect, Stresses due to temperature difference, combined effect of loads and temperature, temperature. Design of RC chimney	10
4	Bunkers & Silos: Introduction, Jassen's theory, Airy's theory, Shallow and deep bins, Design of RC circular/cylindrical bunkers, silos using Jensen's theory as per IS.	11
5	Grid Slabs Introduction, Size of beams & topping, Design of RC Grid slab using Rankine Grashoff Method, Detailing of reinforcement.	06

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
05	10	30	30	20	5

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170626

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. N. Subramaniam, Design of Steel Structures, Oxford University Press
2. S. K. Duggal, Limit State Design of Steel Structure, Tata Mc-Graw-Hill Publishing House
3. S. S. Bhavikatti, Design of Steel Structures: By Limit State Method as Per IS: 800-2007, I K International Publishing House Pvt. Ltd
4. P. Dayaratnam, "Design of Steel Structures", S. Chand Group
5. Dr. H. J. Shah, Reinforced Concrete, Volume-II, Charotar Publishing House Pvt. Ltd.
6. S. S. Bhavikatti, Advance RCC Design, New Age International Publishers Pvt. Ltd
7. N. Subramaniam, Design Reinforced Concrete Structures, Oxford University Press

Course Outcome:

Sr. No.	CO statement	Marks % weightage
CO-1	Identify different structural components & Prepare geometric & structural lay-out of different industrial structures.	25
CO-2	Determined different types of loads & load combinations to be considered on the structures.	25
CO-3	Apply the design principles, procedures and current Indian (or any international) codal provisions for design & detailing of structures.	25
CO-4	Carry out design and structural detailing of different structural components of the structures.	25

Term Work :

Term work shall consist of satisfactory completion and submission of following list of Practicals/Tutorials.

List of Practicals /Tutorials:

1. Full Design of at least 01 industrial structure from any topic with structural detailing in A2 size drawing sheet covering all required details in structural drawing.
2. Solve at least 05 design examples from the topics covered in the syllabus.
3. Software applications of one/two industrial structures with any professional software.
4. Preparation of EXCLE Worksheets for the design of various structural components of Industrial structures.
5. Prepare at least one drawing in any CAD software (like AutoCAD) for any industrial structures.

Practical examinations shall consist of oral based on the term-work and above course.

Major Equipment/Software:

1. Any professional software of Structural analysis such as STAAD-pro, SAP, Tekla



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170626

List of Open Source Software/learning website:

www.nptel.iitm.ac.in/courses/

GTUQuestionPapers.com



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170627

Semester VII

SUBJECT NAME: ICT for Development

Type of course: Undergraduate

Prerequisite: --

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	00	00	100

Syllabus:

Sr. No.	Content	Total Hrs
1	Physical Network Basics of Computer network, Ethernet, Fiber Optics, switching -- packet, circuit, routers, switches - managed, unmanaged	4
2	Communication Network Various Network Topology - Star, Ring, Mesh, etc, Concepts of LAN, WAN, MAN, IP addressing, Class A, Class B and Class C addresses, Subnet, Proxy, OSI layer, Basics of Layered Protocol, Firewall and its importance, Introduction and usage of GIS, RFID technology, Introduction to wireless networks and Mobile network	12
3	Storage and Servers Primary and Secondary storage, Cloud technology, mail server, data server, Concept of Data centers	4
4	Software and applications What is Operating Systems, ERP, CRM, Service Architecture introduction — Concepts of SaaS, PaaS, IaaS	4
5	Introduction to Smart Infrastructure Types of Sensors, How sensor works?, Moisture sensor, tilt sensor, smoke sensor, Temperature Sensor, Pressure Sensor, Level Sensor Fibre Optic Sensors etc., Basics of Internet of Things (IoT), Concept of Smart Home, Smart Meter, Smart Mobility, Smart Public Safety, Smart Sanitation, Smart Security and Surveillance.	12
6	Introduction to Virtualization Concepts of Virtual Machine, Hypervisor, Para-Virtualization, Hardware-level virtualization, Operating System level virtualization	3
7	AR-VR Technology for Development Basics of Augmented Reality and Virtual Reality, AR in navigation, AR in Search Engine, etc.	3

Course outcomes: Students will be able to

1. Understand the basics of Information and communication technology.
2. Explore the applications of ICT in infrastructure



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170627

- Analyse and exploit the merits of ICT to establish more effective infrastructure
- Emerging trends and technologies of IoT, Augmented and Virtual reality for development.

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
30	35	5	0	0	0

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Course outcomes: Students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Understand the basics of Information and communication technology.	30%
CO-2	Explore the applications of ICT for development	30%
CO-3	Analyse and exploit the merits of ICT to establish more effective infrastructure	20%
CO-4	Emerging trends and technologies of IoT, Augmented and Virtual reality for development.	20%

Text and References:

- Online reference material for topics mentioned in syllabus



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170628

Semester –VII

Subject Name: INFRASTRUCTURE FOR SMART CITIES

Type of course: Open Elective-II

Prerequisite: NIL

Rationale:

1. To develop a basic understanding about various types of Infrastructure and Smart city.
2. To enable the students to apply the basic need and planning concept to solve various Infrastructure problems.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE (E)	PA (M)	ESE (V)	PA (I)		
3	0	0	3	70	30	00	00	100

Content:

Sr. No.	Content	Total Hrs
1	Fundamental of smart city & Infrastructure: Introduction of Smart City, Concept of smart city, Objective for smart cities, History of Smart city world and India. Need to develop smart city, Challenges of managing infrastructure in India and world, various types of Infrastructure systems, Infrastructures need assessment	08
2	Planning and development of Smart city Infrastructure : Energy and ecology, solar energy for smart city, Housing, sustainable green building, safety, security, disaster management, economy, cyber security, Project management.	08
3	Intelligent transport systems Smart vehicles and fuels, GIS, GPS, Navigation system, traffic safety management, mobility services, E-ticketing	10
4	Management of water resources and related infrastructure Storage and conveyance system of water, sustainable water and sanitation, sewerage system, flood management, conservation system	08
5	Infrastructure Management system & Policy for Smart city Integrated infrastructure management systems for smart city, Infrastructure management	08



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170628

system applications for existing smart city. Worldwide policies for smart city Government of India - policy for smart city, Mission statement & guidelines, Smart cities in India, Case studies of smart city.	
--	--

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10%	45%	30%	5%	5%	5%

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Smart City on Future Life - Scientific Planning and Construction by Xianyi Li
2. The Age of Intelligent Cities: Smart Environments and Innovation-for-all Strategies (Regions and Cities) by Nicos Komninos
3. Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia by Anthony Townsend
4. Grig N.S., Infrastructure engineering and management, Wiley-Interseience, 1988
5. Hudson W.R., Haas R., Uddin W., Infrastructure Management, McGraw-Hill, 1997
6. Giffinger, Rudolf; Christian Fertner; Hans Kramar; Robert Kalasek; Nataša Pichler-Milanovic; Evert Meijers (2007). "Smart cities – Ranking of European medium-sized cities". Smart Cities. Vienna: Centre of Regional Science
7. Mission statement & guidelines on Smart City Scheme". Government of India - Ministry of Urban Development [http://smartcities.gov.in/upload/uploadfiles/files/Smart City Guidelines\(1\).pdf](http://smartcities.gov.in/upload/uploadfiles/files/Smart%20City%20Guidelines(1).pdf)

Course Outcomes: At the end of the course, Student will be able to;

Sr. No.	CO statement	Weightage
CO-1	Understand the necessity of infrastructural development for smart cities.	20 %
CO-2	Identify components of infrastructure and Prepare infrastructure plan for smart city.	25%
CO-3	Understand smart transport system for smart cities and its application	20%
CO-4	Study of water resources systems for smart city and its application.	20%
CO-5	Understand National and Global policies to implement for smart city development.	15%



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3170628

List of Tutorials/Activities:

1. Differentiate smart city with other city.
2. Projects on Site Selection for major infrastructure.
3. Site visit of Smart city and Prepare report on Case study of smart city
4. List out various smart transport system for smart cities.
5. Prepare breakdown structure for different units of the smart city.
6. Prepare report on Case study of smart city

List of Open Source Software/learning website:

1. Smart city government of India. <http://smartcities.gov.in>
2. Reconceptualising Smart Cities: A Reference Framework for India
https://www.niti.gov.in/writereaddata/files/document_publication/CSTEP%20Report%20Smart%20Cities%20Framework.pdf
3. Draft Concept Note on Smart City Scheme". Government of India - Ministry of Urban Development
[-martcitiesoftomorrow.com/wp-content/uploads/2014/09/CONCEPT_NOTE_3.12.2014__REVISED_AND_LATEST_.pdf](http://martcitiesoftomorrow.com/wp-content/uploads/2014/09/CONCEPT_NOTE_3.12.2014__REVISED_AND_LATEST_.pdf)